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THE NATIONAL RESEARCH COUNCIL

Its Services for Mining and Metallurgy

By ALFRED D. FLINN
Vice-Chairman, Division of Engineering
National Research Council

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Announcement Concerning Publications of the National Research Council

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has been designated as the official organ of the National Research Council for the publication of accounts of research, committee and other reports, and minutes.

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THE NATIONAL RESEARCH COUNCIL

Its Services for Mining and Metallurgy

By Alfred D. Flinn

"Original research, however, is not a science; it is not a collection of laws. It is an art, because it is composed of rules which must be followed. It is the method of finding new truths of nature by study, observation, travel, or other means. The art of research is based upon the laws and principles of nature, and upon the relations of the human mind and senses to the external world. Nature on the one hand, and the human faculties on the other, are the only agents concerned in scientific research. Original discovery has its origin usually in the love of knowledge for its own sake, and in a desire to confer its benefits upon mankind."—G. Gore, LL.D., F. R. S., in "The Art of Scientific Discovery," London, 1878.*

ENGINEERS AND BUSINESS MEN connected with mining and metallurgy will please accept for the purposes of this article the dictum that research in the sciences is the continuingly prolific origin of progress in our modern industries. Many will grant that research for fundamental truth, regardless of its immediate application to industry, must be carried forward with increasing zeal, lest our progress be stalled. This effort must go forward in spite of the fact that many searches appear to produce no immediately utilizable results. In order that ineffective efforts and consequent losses may be minimized, it grows increasingly important that research should be done by thoroughly trained men. There should also be efficient means for cooperation and for exchange of information among men engaged in research, and between them and the men devoted to the numerous branches of technology. To aid in satisfying these needs, the National Research Council exists. The Council's functions are to stimulate, suggest and promote research in the sciences, to assist research men, to further the exchange of information, especially among groups working in various scientific fields, and to establish liaisons among scientists, technologists and managers of industry.

* A copy of this book was recently sent to Engineering Foundation and Engineering Societies Library by Sir Robert A. Hadfield, the recent recipient of the John Fritz Medal for the invention of manganese steel, with the following autographed note on the flyleaf: "This book of Gore's has always possessed a fascination for me and I have been fortunate to obtain a copy, as it is now quite scarce. I send it with my best wishes.—June 29, 1921."

Established in 1916 by the cooperation of scientific and engineering societies and the Engineering Foundation with the National Academy of Sciences, the National Research Council performed many special services during the World War, of great value to our country and its allies. The Research Council was organized under the federal charter granted to the National Academy of Sciences in 1863. On May 11, 1918, the president issued an executive order which gave permanence to the Council and provided for the co-operation of the governmental departments. The National Research Council, however, receives no pecuniary support from the government, although during the war the government provided funds for some of the work which the Council did for the government.

Financial support for the National Research Council comes wholly from private funds provided by endowed foundations, scientific and technical societies, industrial organizations, and individuals. In December, 1919, the Carnegie Corporation of New York voted to the National Academy of Sciences for the National Research Council the sum of five million dollars to become available July 1, 1922. Of this gift not to exceed one-quarter may be used for a building, and the remainder is to be an endowment, the income from which is to be used for the current expenses of the Council. A condition precedent to this gift was the purchase of a suitable site for the proposed building by means of funds obtained from other sources. This condition was met by procuring a large plot of ground in Washington near the Lincoln Memorial, bounded on all sides by streets. From the land purchase fund, a balance remains on investment providing income for perpetual upkeep. Plans for the building have been drawn by Mr. Bertram G. Goodhue, architect, of New York, and preparations for construction are well advanced. This building will be a dignified, beautiful and practical structure, appropriate for the permanent home of the National Research Council and the National Academy of Sciences. Pending the construction of its new building, National Research Council occupies as its headquarters the building at 1701 Massachusetts Avenue.

The scope of activities of the National Research council as now organized, is the "promotion of research in the physical and biological sciences and the encouragement of the application and dissemination of scientific knowledge for the benefit of the nation. The Council is neither a large operating scientific laboratory,

nor a repository of large funds to be given away to scattered scientific workers or institutions. It is rather an organization, which while clearly recognizing the unique value of individual work, hopes especially to help bring together the scattered work and workers and to assist in coordinating scientific attack in America on large problems, especially those which depend for successful solution on the cooperation of several or many workers and laboratories, either within the realms of a single science, or different realms, in which various parts of a single problem may lie. It particularly intends not to duplicate nor to interfere with work already under way. It hopes to help maintain the morale of devoted isolated investigators and to stimulate renewed effort among groups willing but halted by obstacles. It will try to encourage the interest of universities and colleges in research work, and the training of research workers, so that the inspiration and fitting of American youth for scientific work may never fall so low as to threaten to interrupt the constantly needed output of well trained and devoted scientific talent in the land." (Fifth Annual Report.)

For accomplishment of the purposes stated, the Council is now organized in six divisions of General Relations and seven divisions of Science and Technology, under the general direction of an executive board. The form of organization is so flexible that it may be and is being adapted, from time to time, to meet the varying requirements of the societies and industries which the Council seeks to serve.

Divisions of General Relations

		Chairman
I	Division of Federal Relations	Charles D. Walcott
II	Division of Foreign Relations	Robert A. Millikan
III	Division of States Relations	John C. Merriam
IV	Division of Educational Relations	Vernon Kellogg
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VI	Research Information Service	Robert M. Yerkes

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		Chairman
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X	Division of Geology and Geography	E. B. Mathews
XI	Division of Medical Sciences	Victor C. Vaughan
XII	Division of Biology and Agriculture	L. R. Jones
XIII	Division of Anthropology and Psychology	C. E. Seashore

As now constituted, the chief purpose of the Council is to organize scientific effort, to survey and collate, and

to initiate, promote and stimulate research in science and its useful applications. The membership of the Council in its divisions consists of representatives officially designated by leading scientific and technical societies of national scope, representatives of the government, representatives of other particular research organizations, and members at large chosen by the divisions.

The chairman of the executive board is Dr. John C. Merriam, who is also president of the Carnegie Institution of Washington. The permanent secretary is Dr. Vernon Kellogg. Dr. George E. Hale, director of Mt. Wilson Observatory, was the first chairman of the Council and is now its honorary chairman. The vice-chairmen are Dr. Charles D. Walcott, secretary, Smithsonian Institution and president of the National Academy of Sciences; Mr. Gano Dunn, president of the J. G. White Engineering Corporation, and Dr. R. A. Millikan, professor of physics, California Institute of Technology. The treasurer is F. L. Ransome, geologist in charge, section of metalliferous deposits, U. S. Geological Survey, who is also treasurer, National Academy of Sciences. The executive board and the divisions work through committees, of which there is a large number. Membership in committees is not limited to the members of the Research Council.

National Research Council is in effect an "overhead" or advisory organization. The limited funds at its disposal are only sufficient for its expenses. Consequently funds for experimental research or for the support of other projects organized or promoted by the Council must be provided by the interested societies, industrial organizations or individuals, or be secured by special solicitation. The Council can assist in soliciting financial support, but ordinarily it cannot contribute from its own resources.

Among the noteworthy projects which have been financed, or for which funds are being sought by the National Research Council, there may be mentioned, research fellowships in physics and chemistry, research in the fatigue phenomena of metals, tables of physical and chemical constants, highway research, heat treatment of steel, Alloys Research Association, Personnel Research Federation. For the research fellowships, the Rockefeller Foundation contributed five hundred thousand dollars, to become available in equal annual installments during a period of five years. The Engineering Foundation and the General Electric Company each contributed thirty thousand dollars for the support of

the fatigue of metals research, and other large gifts have been made by the General Education Board, the Commonwealth Fund, the American Telephone and Telegraph Company, the Southern Pine Association, and a number of industrial corporations, for sundry projects.

Records of the actions of the National Research Council are printed in the "Proceedings" of the National Academy of Sciences. Reports on researches and other investigations are published in the journals of the interested societies or in the bulletins of the universities or laboratories conducting the work. The Council publishes bulletins at irregular intervals, which are assembled in volumes of approximately five hundred pages, and a "Reprint and Circular Series" of pamphlets, any of which may be purchased at moderate prices. Many copies of these publications are distributed gratuitously for publicity and educational purposes. A list may be obtained, by request, from the publication office of the National Research Council, 1701 Massachusetts Avenue, Washington, D. C.

Supplementing its publications, National Research Council has made use of special exhibits and lectures for extending interest in research. Exhibits relating to wireless telephony and to gas warfare, besides being shown for protracted periods at headquarters in Washington, were each sent to other cities. Carefully planned publicity through technical and popular journals is also employed in the process of "educating the public." A department has been maintained in the *Scientific American Monthly*, in which accounts of some of the scientific activities of the Council, together with other articles on special phases of science, have been published.

With the financial support of Mr. E. A. Scripps, of California, a Science Service for dissemination by newspapers, magazines, lectures, motion pictures and conferences, of authentic popular information on science has been organized under the joint auspices of the National Research Council, the National Academy of Sciences, the American Association for the Advancement of Science, the Scripps Estate, and a group of professional journals. The editor and secretary is Dr. E. E. Slosson, a well-known writer and scientist, formerly associate editor of the *Independent* (New York), and the manager is Mr. Howard D. Wheeler, formerly managing editor of *Harper's Weekly*. The Science Service has temporary headquarters in the building of the National Research Council.

International relations among scientific organizations have been initiated and fostered by National Research

Council. Growing partly out of the war work and partly out of pre-war connections, the international associations will be particularly helpful in those branches of science and technology requiring information gathered by observation in many parts of the world.

So broad are the interests and so extended the connections of mining and metallurgical men, that there is not a division of National Research Council whose work lacks definite usefulness to them at some time or in some phase. A perusal of the annual report of the Council, which can be had on request, would clearly show this fact. Of special interest, however, are the Division of Engineering, Division of Research Extension, Research Information Service, Division of Chemistry and Chemical Technology, and Division of Geology and Geography. Space limitation precludes even the bare listing of the subjects of importance to the American Mining Congress, which have received consideration by the divisions named. There may be mentioned, simply by way of example: fatigue of metals, heat treatment of carbon steel, substitute deoxidizers, new uses for selenium and tellurium, physical changes in iron and steel below the thermal critical range, pulverizing, Neumann bands, hardness testing, welding, molding sand, ceramics (especially relating to refractories), explosives investigations, organization of Alloys Research Association, collection of information about research laboratories and scientific personnel, establishment of a service for making sources of information available to inquirers and for answering questions directly, and various geological problems.

National Research Council is closely affiliated with the leading engineering societies and Engineering Foundation, especially through its Division of Engineering. Offices for the latter have been provided in Engineering Societies Building by Engineering Foundation, which contributes also to the financial support of the Division and some of its research projects. Mr. Charles F. Rand, chairman of Engineering Foundation, and a member of the Division of Engineering, is a past-president of the American Institute of Mining and Metallurgical Engineers and has long been active in the Institute's work. While in England with the delegation of American engineers, in June, he was made an honorary member of the Iron and Steel Institute, the Institution of Mining and Metallurgy, and the Institution of Mining Engineers.

Dr. Henry M. Howe, the distinguished iron and steel metallurgist, also a past-president of the American Insti-

tute of Mining and Metallurgical Engineers, was the first chairman and is now the Honorary Chairman of the Division of Engineering. Mr. Galen H. Clevenger, long identified with nonferrous mining and metallurgy, is a vice-chairman of the division. The other vice-chairman, also, is a member of the Institute. Of this division's thirty-eight members, eighteen are members of the American Institute of Mining and Metallurgical Engineers, although a number of them officially represent other societies on the division. Many other mining engineers and metallurgists are members of committees of the National Research Council. Among the engineering societies the Institute has been prominent as an active participant in the work of the Council. During the war, many Institute members served untiringly on committees of the Council engaged upon mining and metallurgical problems for the Government and the industries. Five members of the Institute were among the founders of National Research Council: Herbert Hoover, Van H. Manning, Charles F. Rand, Charles D. Walcott and Willis R. Whitney. Dr. Walcott is President of the National Academy of Sciences, and First Vice-Chairman of the National Research Council.

Valuable as are the specific scientific and technical achievements which National Research Council already has to its credit, and the greater achievements of this kind in its future, none nor all of them can outweigh the great benefits to our country and the world growing from the better personal appreciation, the higher mutual esteem, and the effective cooperation which National Research Council is helping to bring about among scientists, technologists and industrialists. National Research Council exists to serve. Through service it expects "to have and to hold" the steady, sympathetic backing of mining and metallurgical men.

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